

FY-2002 PROPOSED SCOPE OF WORK for:
Green/Yampa Sediment Monitoring

Project #: 85B

Lead Agency: U.S. Fish and Wildlife Service

Submitted by: George Smith, Division of Water Resources
P.O. Box 25486, DFC, Denver, CO 80225-0486
Phone: (303) 236-5322
Fax: (303) 236-4224
george_smith@fws.gov

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Category:

- ☐ Ongoing Project
☒ Ongoing Revised Project
☐ Requested New Project
☐ Unsolicited Proposal

Expected Funding Source:

- ☐ Annual Funds
☐ Capital Funds
☒ O&M Funds

I. Title of Proposal:

Green and Yampa River Basin Sediment Monitoring Program

II. Relation to RIPRAP:

Green River Action Plan: Yampa and Little Snake Rivers
1.A.1.f. Install, operate and/or maintain stream flow and sediment monitoring gages

III. Study Background/Rationale and Hypotheses:

The Colorado River Recovery Program Director and Water Acquisition Committee have identified a need to better define the requirements, appropriate methodologies, and levels of effort for a sediment monitoring program to help define habitat requirements for endangered native fish in the Yampa, Little Snake, and Green Rivers. To meet that need, an independent peer review panel was formed to review historical data, review the status of ongoing data collection efforts, identify sediment issues as they relate to recovery of endangered fishes, and develop recommendations for future sediment work to support Program efforts. To accomplish the goals of the peer review panel, a summary of available sediment and river channel information was compiled by Mussetter Engineering, Inc. (MEI) and a one-day workshop involving the other members of the panel and other interested parties was conducted. This proposal was developed based on recommendations resulting from the peer review workshop. The peer review panel strongly believes that the success of the proposed sediment monitoring program is contingent on a long-term (minimum 10 years) commitment to the data collection and analysis efforts.

In developing the recommendations, the peer review panel considered a number of issues related to man-induced factors that have affected the flow patterns and sediment delivery to the Yampa and Green Rivers, and the potential effects of those factors on the suitability of

spawning and other life-stage habitat for the endangered fish. The water resources of the Upper Colorado River basin have been extensively developed for water supply, irrigation, and power generation. The net effect of the development has been to significantly modify the pre-development annual hydrograph through water storage in upstream reservoirs, and subsequent releases during the remainder of the year. Under pre-development conditions, peak flows from the snowmelt runoff were higher, and non-snowmelt runoff flows were lower than occurs under present conditions. Presently, peak flows are stored within reservoirs and are subsequently released during the remainder of the year. The Yampa River is the only large river in the Upper Colorado River basin in which flow patterns have not been substantially altered by water development projects (Tyus and Karp, 1989), and therefore, is probably the best river in which to evaluate the specific habitat requirements of the endangered fish species (Tyus, 1992).

Closure of Flaming Gorge Dam in 1962 has not appreciably affected the mean annual water discharge of the Green River (Andrews, 1986), but has significantly reduced the magnitude of the flood peaks (e.g., the 100-year peak flow has been reduced by about 21,000 cfs) (Harvey and Mussetter, 1994). The 90 percent exceedence flow for the pre- and post- Flaming Gorge periods are 1,500 and 2,300 cfs, respectively, which indicates that there has been a significant increase in the flow magnitude during the low-flow periods of the year. Because of the changes in the flow duration curve, the mean annual sediment load has decreased by about 54 percent at the Jensen gage and by about 48 percent at the Green River gage (Andrews, 1986).

Andrews (1986) evaluated the effects of the dams on the stability of the Green River, and concluded that it was degradational upstream of the Yampa River, in approximate equilibrium from the Yampa River confluence to the Duchesne River, and aggradational in the reach downstream of the Duchesne River. He further concluded that, in the alluvial reaches downstream of Jensen, channel width between 1964 and 1978 decreased by about 13 percent (700 feet to 610 feet) and would have to decrease by a total of about 25 percent (700 feet to 524 feet) to reach equilibrium. Most bank width reduction was due to bank attachment of mid-channel bars, but the number of mid-channel bars through the reach increased significantly during the period. In contrast, Lyons (1991) concluded that an equilibrium channel width that was about 13 percent less than the pre-dam width had been re-established in the Jensen reach by 1974. Downstream of Green River, Utah, channel width had reduced by about 5 percent (474 feet to 454 feet) by 1981.

In addition to those specifically mentioned above, many other studies have been performed during the last few decades to characterize the flow, sediment transport, and sediment storage dynamics of the Yampa and Green River systems. In preparing the summary of existing data for the peer review workshop, MEI also prepared a bibliography of studies that are potentially relevant to the proposed sediment monitoring program (**Attachment is available from the principal investigator**).

The two primary factors that have affected, and are likely to continue to affect, the habitat characteristics of the Yampa and Green Rivers are flow modification and sediment trapping by Flaming Gorge Dam on the Green River, and land use changes and water development in the Yampa and Little Snake River basins.

Specific critical areas within the system that could be affected by the flow modifications and land use activities include:

- Spawning habitat at the Razorback Bar near Jensen, UT,
- Channel capacity and overbank flows in the flooded bottomland area between Split Mountain and Sand Wash,
- Sediment storage and movement through Browns Park, Lodore Canyon, and Rainbow-Island Park on the Green River,
- Sediment storage in Deerlodge Park on the Yampa River,
- Channel adjustments, sediment storage and cottonwood regeneration in Echo Park,
- Squawfish spawning habitat in the lower Yampa Canyon, at Three Fords West, and at other sites on the Green River,
- Razorback sucker spawning habitat near the mouth of the Yampa River, at the Razorback Bar and Escalante reach, and near the mouth of the San Rafael River,
- Low-flow fish passage in the Cross Mountain reach of the Yampa River, and
- Fish passage at Tusher Wash on the Green River.

The work proposed here will build on the existing body of knowledge and will provide information to specifically address those portions of the above issues that relate to sediment movement and storage and their effects on channel dynamics of the Yampa and Green River systems.

IV. Study Goals, Objectives, End Products:

A. Goals:

The goal of the sediment monitoring program is to provide information with which to evaluate changes in the magnitude, timing, and caliber of sediment delivery to the Yampa and Green River systems resulting from water resource development and land use changes in the basin, and their potential effects on the riverine ecosystem, specifically as they relate to recovery of the endangered fishes.

B. Objectives:

1. To evaluate the dynamics of sediment movement in the Yampa and Green Rivers by conducting and analyzing sediment load, including suspended sediment and bed load, and bed material samples at key points along the system. To evaluate the effects of the flows and sediment movement on the morphometric and bed material characteristics of the Green River by surveying repeat cross sections surveys at several key points along the system.

C. End Products:

An completion report will be prepared after each years work which summarizes the sediment and morphometric information collected. After the first 3 years of the program, the data and a detailed evaluation of the results should be formally published to insure that the information is readily available to resource managers, decision makers, and scientists with an interest in the Yampa and Green River system. The report will contain an evaluation how the findings can be used to assist with management decisions on water and land management issues. A USGS Water-Resource Investigations Report may be an appropriate forum for such a publication

V. Study Area:

Yampa River and Green River Basins.

VI. Study Method/Approach:

The project objectives will be met by performing suspended-sediment and bed-load measurements, bed material sampling, and cross-section surveys at several strategically selected locations along the Yampa and Green River systems. The sampling and survey locations are described in the following section, and have been selected to take maximum advantage of historic and ongoing data collection efforts and to provide data locations that are believed to be important to the habitat requirements of the endangered fishes. The sediment sampling and cross section surveys will be conducted by experienced personnel using standard U.S. Geological Survey techniques.

VII. Task Description and Schedule: ***NOTE*** The following list of tasks was modified to include only tasks which were appropriate for funding under the Yampa River Management Plan. The plan is to implement the scope of work for Green and Yampa River Sediment monitoring Program as outlined by the peer review panel over several years.

- A. An ongoing bed-load and bed-material sampling program will be established at the Deerlodge Park gage on the Yampa River, to supplement the already established program of suspended sediment measurements that is being conducted by the U.S. Geological Survey, in cooperation with the Recovery Program and Colorado River Water Conservation District. Nine (9) samples of each parameter will be collected per year.
- B. An ongoing suspended-sediment and bed-load measuring program and bed-material sampling program will be established at an appropriate site on the Yampa River between the Little Snake River confluence and the mouth of Cross Mountain Canyon. These parameters will also be sampled nine (9) times per year.
- C. An ongoing sediment-load measuring program, including both suspended- and bed- load, and a bed-material sampling program will be re-established at the Jensen gage on the Green River. Ten (10) samples of each parameter will be collected per year. An annual report will be prepared to summarize data collected during that year, present comparisons of the newly collected data with previous data, and provide an evaluation of the

relationship between the magnitude and duration of the streamflow at associated sites relative to sediment transport balance through the system and the morphological changes to the river channel.

- D. An annual report will be prepared to summarize data collected during that year, present comparisons of the newly collected data with previous data, and provide an evaluation of the relationship between the magnitude and duration of the streamflow at associated sites relative to sediment transport balance through the system and the morphological changes to the river channel.
- E. Report Preparation Phase 2000-2001; After the third year of the program, a detailed evaluation of the results will be prepared for publication as a USGS Water-Resources Investigations report. This report will focus on trends in both the sediment load and morphometric (cross section) data, and their implications to management decisions that would provide flows to maintain or improve habitat conditions for the endangered fish.
- F. Continue collection of sediment data at the Lily gage on the Little Snake River which was dropped by the Colorado River Water Conservation District.

VIII. FY-98 & 99 Work:

Deliverables: The field work will be conducted as described in A through D above and in addition a 1-year sediment monitoring program will be conducted near the confluence of the Green and Yampa Rivers. The goal of the work will be to establish the relationship between sediment load and discharge in the two rivers, and to define the sediment load discharge from Lodore Canyon during high flows. Three sampling sites will be established for this task: lower Yampa River just upstream from Echo Park, Green River just upstream from the Yampa River confluence, and Green River in Echo Park downstream from the confluence. The following data will be collected at each location (minimum 10 sets per year): The data collection for Lodore canyon will be implemented by the National Park Service.

- Sediment load measurements, including suspended sediment and bed load
- Bed material samples
- Discharge measurements
- One cross-section survey

Budget:

| By Task: | | By Cost Category: | |
|----------|------------|-------------------|-----------|
| A. | \$ 5,000 | Labor: | \$ 21,900 |
| B. | \$ 7,400 | Travel: | \$ 3,200 |
| C. | \$ 17,200* | Equip: | \$ 1,900 |
| D. | \$ 2,000 | Lab: | \$ 4,000 |
| E. | \$ 0 | Other: | \$,600 |
| F. | \$ 0 | Total: | \$ 31,600 |
| Total | \$ 31,600 | | |

* Number of samples will be increased to 20 and USGS will provide additional data analysis if \$ 25,000 of match funds become available.

FY-2000 Work:

Work: Continue data collections as described in Element VII Tasks A, B and C. Continue collection of sediment data the Lily gage which was dropped by the Colorado River Water Conservation District at a cost of 10,000. Prepare a final report on the 3 year sediment monitoring effort.

Deliverables: FY 2000 will be the last year of data collection for the 3 sampling locations. The one year confluence study was dropped for FY98 because of funding limitations. Once data collection has been completed in June of 2000 work will begin on preparation of the final report for the sediment data collection effort. The report will be completed by October 1, 2000. The report will included a summary of the data, guidelines for using the data to calibrate sediment models for the Yampa River and recommendations for future sediment data collection if needed. The recommendation for the continuation of sediment monitoring effort for the Little Snake River will be included in the report.

Budget: By Task:

A. \$ 17,200*
B. \$ 7,400
C. \$ 10,200*
D. \$ 2,000
E \$ 26,400
F. \$ 10,000
Total \$ 66,000

By Cost Category:

Labor: \$ 50,800
Travel: \$ 6,200
Equip: \$ 1,000
Other: \$ 8,000
Total \$ 66,000

* Number of samples will be increased to 20 and USGS will provide additional data analysis if \$ 25,000 of USGS match funds become available.

FY-2001 Work:

In anticipation of a need to continue sediment collection on the Little Snake River a contingency of \$15,000 is recommended for FY 2001. In anticipation of a need to continue collection of sediment data above and below Deerlodge Park on the Yampa River and at Jensen on the Green River, of \$30,000. The need to continue the Deerlodge Park and Jensen sediment collection will be clarified whin the USGS completes it comprehensives review of the sediment data by July 31, 2001.

Summer 2001. Budget:

Budget:

By Task:

A. \$ 0
B. \$ 0

By Cost Category:

Labor: \$ 27,000
Travel: \$ 7,000

| | | | |
|-------|------------------|---------------|----------------------|
| C. | \$ 30,000* | Equipment: | \$ 1,000 |
| D. | \$ 0 | <u>Other:</u> | <u>\$ 10,000 Lab</u> |
| E. | \$ 0 | Total | \$ 45,000 |
| F. | <u>\$ 15,000</u> | | |
| Total | \$ 45,000 | | |

* Number of samples will be increased to 20 and USGS will provide additional data analysis if \$ 25,000 of USGS match funds become available.

2002 Work

2002 work will be scaled back to a standardized monitoring program as described in Element VII Tasks A, B, C, and D above. Based on results of the report completed in 2001 the timing of sample collection will be closely coordinated with river flow to fill in the gaps in the sediment record. A new Task E will be added in FY 2002 to collect several bedload samples at the razorback bar near the confluence of the Yampa and Green Rivers. The samples will be collected in the spawning channel to help calibrate the work that is being done under SOW 85D using load-cells to provide a time series of sediment movement.

2002 Budget by task

| | |
|-------|------------------|
| A. | \$ 9,750 |
| B. | \$ 9,750 |
| C. | \$ 9,750 |
| D. | \$ 2,000 |
| E. | \$ 0 |
| E. | <u>\$ 13,750</u> |
| Total | \$ 45,000 |

The USGS will provide \$26,000 match for a total project of \$65,000

2003 Budget Estimate by task

| | |
|-------|------------------|
| A. | \$ 10,000 |
| B. | \$ 10,000 |
| C. | \$ 10,000 |
| D. | \$ 2,000 |
| E. | \$ 0 |
| E. | <u>\$ 13,000</u> |
| Total | \$ 45,000 |

The USGS will provide \$26,000 match for a total project of \$65,000

IX. Budget Summary:

FY-1998: \$31,600
FY-1999: \$31,000

FY-2000: \$66,000
FY-2001 \$45,000
FY-2002 \$45,000
FY-2003 \$45,000

X. Reviewers:

This proposal was prepared from specific recommendations that were developed by the Yampa River Basin Sediment Peer Review Panel. The work was reprioritized to meet the needs of the Yampa Management Plan and Recovery Program needs. Members of the panel included:

Dr. Bob Mussetter, Mussetter Engineering, Inc. (Workshop Coordinator)
Dr. Mike Harvey, Mussetter Engineering, Inc.
Dr. Ned Andrews, U.S. Geological Survey
Mr. John Elliott, U.S. Geological Survey
Mr. Paul vonGuerard, U.S. Geological Survey
Dr. Jim O'Brien, FLO Engineering, Inc.

XI. References: See Attachment 1 (Available from the principal investigator).